

CLAIMS

What is claimed is:

1. A device comprising:
a plurality of primary electrodes;
a secondary electrode positioned between the plurality of primary electrodes;
a first circuit for supplying power to the plurality of primary electrodes; and
a second circuit for supplying power between the secondary electrode and alternate ones of the primary electrodes.
2. The device of claim 1, wherein the first circuit is independent of the second circuit.
3. The device of claim 1, wherein the primary electrodes are symmetric about a central axis.
4. The device of claim 3, wherein the secondary electrode is positioned on the central axis.
5. The device of claim 3, wherein the primary electrodes comprise one or more pairs of primary electrodes.
6. The device of claim 1, wherein the second circuit is configured to apply pulses of high voltage between the secondary electrode and alternate ones of the primary electrodes.
7. The device of claim 6, wherein the time between pulses is less than the duration of a discharge between a pair of primary electrodes.
8. The device of claim 6, wherein the duration of each pulse is sufficient to produce a single spark per pulse.
9. The device of claim 1, wherein a voltage applied by the second circuit between the secondary electrode and the primary electrodes is at least about 10 times greater than a voltage applied by the first circuit between the primary electrodes.

10. The device of claim 1, wherein the secondary electrode is star-shaped, wherein each arm of the star extends toward a corresponding one of the primary electrodes.
11. The device of claim 1, wherein the secondary electrode is tapered, such that a first end of the secondary electrode is closer to the primary electrodes than a second end of the secondary electrode.
12. A method comprising:
providing a plurality of primary electrodes;
positioning a secondary electrode between the plurality of primary electrodes;
applying a first voltage between pairs of the primary electrodes; and
applying a second voltage between the secondary electrode and alternate ones of the primary electrodes.
13. The method of claim 12, wherein the first voltage is applied by first circuit and the second voltage is applied by a second circuit which is independent of the first circuit.
14. The method of claim 12, further comprising positioning the primary electrodes symmetrically about a central axis.
15. The method of claim 14, wherein positioning the secondary electrode comprises positioning the secondary electrode on the central axis.
16. The method of claim 12, wherein the second voltage is applied in pulses.
17. The method of claim 16, wherein the time between pulses is less than the duration of a discharge between a pair of primary electrodes.
18. The method of claim 16, wherein the second voltage is applied for a period sufficient to produce a single spark per pulse.
19. The method of claim 12, wherein the second voltage is at least about 10 times greater than the first voltage.

20. The method of claim 12, wherein the secondary electrode is star-shaped and wherein positioning the secondary electrode comprises positioning the secondary electrode with each arm of the star extending toward a corresponding one of the primary electrodes.
21. The method of claim 12, wherein the secondary electrode is tapered, such that a first end of the secondary electrode is closer to the primary electrodes than a second end of the secondary electrode.
22. A method for establishing unstable discharges between a pair of primary electrodes in a gas-filled reaction chamber, the method comprising:
- (a) positioning a secondary electrode between the primary electrodes;
 - (b) applying a first voltage between the primary electrodes, wherein the first voltage is not sufficient to initiate a discharge in the absence of ionization of the gas;
 - (c) applying a pulse of a second voltage between the secondary electrode and a first one of the primary electrodes to produce a first pilot discharge and corresponding ionization path;
 - (d) applying a pulse of the second voltage between the secondary electrode and a second one of the primary electrodes to produce a second pilot discharge and corresponding ionization path; and
 - (e) producing a primary discharge between the primary electrodes along the ionization paths produced by the pilot discharges.
23. The method of claim 22, wherein the first voltage is generated by a first circuit and the second voltage is generated by a second circuit which is independent of the first circuit.
24. The method of claim 22, further comprising repeating (c) – (e) one or more times.
25. A reactor comprising:
- a reaction chamber;
 - a plurality of primary electrodes positioned in the reaction chamber;
 - a secondary electrode positioned between the plurality of primary electrodes;
 - a first circuit for supplying power to the plurality of primary electrodes; and

a second circuit for supplying power between the secondary electrode and alternate ones of the primary electrodes;

wherein the reactor is configured to produce pilot discharges between the secondary electrode and alternate ones of the primary electrodes, wherein the pilot discharges produce ionization paths through a gas in the reactor and primary discharges between the primary electrodes are established along the ionization paths.

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